BOVINE COLOSTRUM AS A RESOURCE FOR THE POWERFUL ANTIOXIDANT GLUTATHIONE

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Antioxidants are a type of molecule that can neutralize harmful substances, called “free radicals”, which can damage living cells. Free radicals are also responsible for food spoilage and the degradation of other materials such as gasoline, rubber and lubricating oils. Antioxidants that are useful in protecting cells from free radical damage usually take the form of enzymes in the body, certain vitamins and specific peptides found within the cells.

“Free radicals” are produced during normal cellular functions within the body. A free radical is a molecule that is missing an electron, which gives it a charge, making it unbalanced. To neutralize this charge, free radicals try to capture an electron or give up an electron from/to a neighboring molecule through a process called “oxidation”. When this occurs, the neighboring molecule then becomes a free radical that, in turn, tries to capture or give up an electron from/to another neighboring molecule, setting up a chain reaction that can damage many molecules within a cell. An antioxidant molecule halts this chain reaction by either a) destroying the free radicals before they initiate the chain reaction that leads to oxidative cell damage; or b) as a free radical itself, capturing or giving up an electron to stabilize and neutralize the dangerous free radicals.

About five percent of the oxygen that a human breathes is converted into free radicals, but the presence of free radicals is not always detrimental. Some free radicals are produced during normal metabolism and are essential to support certain bodily functions. For example, when tissue is diseased or damaged, the host’s immune system sends white blood cells to the site, where they produce free radicals as part of an effort to destroy a foreign invader.

However, as the body ages and is exposed to environmental pollutants, such as smog, cigarette smoke and overexposure to sunlight, it can become saturated with free radicals and the excess free radicals cause damage by capturing or giving up electrons from/to key substances within cells in the body. The resulting reactions can, among other things, make the affected cells more susceptible to cancer-causing chemicals; increase the risk of heart disease by oxidizing low-density lipoprotein (“bad” cholesterol); and increase the risk of cataract formation.

Glutathione is the most significant antioxidant produced by a cell. It participates directly in the neutralization of free radicals and reactive oxygen compounds and maintains other antioxidants, such as vitamins C and E in their active forms. In addition, glutathione can interact with

many organic and inorganic substances and assist the body in detoxifying them.

When glutathione is ingested by mouth, absorption into the body is negligible and, thus, it must be manufactured inside of the cell. It is a tripeptide made up of three amino acids, cysteine, glycine and glutamic acid. Both glycine and glutamic acid are readily available in the diet of most individuals, but cysteine is not, making it the rate-limiting substance for glutathione synthesis within the cell. As the free amino acid, cysteine is potentially toxic and is broken down in the gastrointestinal tract and the blood. The most stable form of this amino acid is as cystine, which is two cysteine molecules linked together by a disulfide bond. Cystine is not broken down by stomach acid or proteolytic enzymes and is readily absorbed. It is rapidly reduced to two cysteine molecules when it enters a cell.

The proteins albumin, lactoferrin and lactalbumin found in substantial amounts in first milking bovine colostrum are excellent resources for cystine. As shown in the table below, taken from the Handbook of Dairy Chemistry, the amount of albumin is highest in first milking colostrum and diminishes with time after birth. Transitional milk, obtained at 96 hours (4 days) after birth of the calf, contains only about 20% of the albumin found in first milking bovine colostrum taken within 6 hours after birth. Thus, first milking bovine colostrum contains approximately 5x more albumin than milk and, therefore, contributes at least 5x more cystine from albumin than milk.

COMPOSITION OF
DRIED BOVINE COLSTRUM & TRANSITIONAL MILK
(from Handbook of Dairy Chemistry)

Hours After Calving	% Total Protein	% Albumin	% Lactose
0	65.10	42.02	8.11
6	48.90	30.79	13.25
12	41.64	20.37	25.53
24	35.40	11.59	31.17
48	32.64	8.64	34.64
72	32.55	8.18	36.85
96	31.73	6.92	39.83

Lactoferrin is a unique protein capable of binding and transporting iron and copper into cells in the body. Like most of the biologically active substances in complete, high quality first milking bovine colostrum, the largest quantities of lactoferrin are transferred into the colostrum from the mother's circulation just prior to birth of the calf, a process that essentially ceases, due to hormonal shifts, when birth occurs. Subsequent to birth, only comparatively small amounts of lactoferrin are found in milk. Recent studies at a major veterinary diagnostic laboratory have shown that high quality first milking bovine colostrum contains approximately 400 ug/ml of lactoferrin.

Alpha-lactalbumin is a protein produced by cells in the udder and found in both colostrum and milk. It combines with an enzyme to form a substance known as lactose synthetase, which increases the rate of lactose (milk sugar) formation by cells in the udder. As shown in the table above, lactose production in the udder is lowest at birth of the calf and rapidly increases with time. This occurs primarily because the calf grows at a very rapid rate during the period after birth and needs a lot of metabolic energy. Lactose is easily broken down during digestion to glucose and galactose. Under the direction of insulin-like growth factor-1 (IGF-1) and insulin, glucose is converted to glycogen, which is an excellent source for the required metabolic energy.

The obvious conclusion is that high quality first milking bovine colostrum is a substantial resource for the cystine required to form glutathione in cells. The fact that first milking bovine colostrum contains substantially more albumin and lactoferrin, as primary sources of cystine, than any subsequent milking clearly indicates that it is a far superior resource.

Several commercial products, such as MaxGXL and Immunocal, claim to be resources for the nutrients needed to form glutathione. These manufacturer's also claim that their products, among other things, compensate for the body's accelerated use of glutathione, strengthen your natural defenses, decrease your risk of illness and guard against the effects of the body's aging process. Although glutathione plays a role in host defense and the aging process, it is not the sole operational entity responsible for these functions. Thus, it is ludicrous to claim such effects for products whose sole purpose is to support intracellular generation of the antioxidant glutathione when these systems are hormonally controlled and the age-related deterioration of the systems is due to a diminishing ability of the host to generate the required hormones to sustain their functions.

There is little speculation about the effects of high quality first milking bovine colostrum on the immune system since it is well documented in the scientific literature that it is an immuno-modulating agent and has a broad influence on the functioning of the immune system following routine dietary supplementation. Some of the components in colostrum have one or more effects on the overall regulation and functioning of the immune system (immuno-regulating substances), while others are very restricted in what they can do and, thus, their benefits may be very localized in the body, ordinarily exerting their benefits primarily in the digestive tract (gut protective factors).

Accelerated deterioration of cells and diminished metabolism are normal manifestations of the aging process. There are very small quantities of growth hormone in complete first milking colostrum, but growth hormone is an extremely potent hormone and, thus, not much is required. It directly affects almost every cell in the body and significantly influences the development of new cells, causing them to generate at a more rapid rate when a sufficient quantity of the hormone

is present. Scientific studies have shown that one of the benefits of ingesting even small amounts of growth hormone is limitation of the deterioration of cells associated with the aging process. In addition, more recent studies have shown that small doses of growth hormone can accelerate repair of the muscle damage associated with congestive heart failure.

Insulin-like growth factor-1 (IGF-1) and its closely related counterpart insulin-like growth factor-2 (IGF-2) are potent hormones that are found in association with almost every cell in the body and are also present in first milking bovine colostrum. IGF-1 is the most potent and best described of this pair and is the director of an IGF Binding Protein Superfamily of proteins. IGF-1 and IGF-2 are present in all mammals and, in every case, have a very similar chemical structure regardless of the species.

The main events triggered by these hormones include activation of the process by which the cell grows and reproduces itself and maintenance of the metabolic pathways by which the cell converts glucose into glycogen and uses amino acids to create proteins. The actual pathway by which the cell uses glucose and converts it to glycogen is first switched on by the binding of insulin to its specific cell surface receptors. Glycogen is stored in the liver and muscles and is the reserve source of readily available energy when the muscles are exercised. The IGFBP Superfamily also has a direct role in how the cell uses amino acids to build proteins. As we age, the ability of our body to create an adequate supply of IGF-1 is diminished. Thus, by eating a well-balanced diet and maintaining a constant supply of IGF-1 in our body, we can keep the ship moving at the right speed and in the right direction. And when we exercise this becomes even more critical since there is an increased demand for glycogen to provide energy to our muscles and the preference is to build more muscle protein. Even more importantly, as we age the cells in our body do not reproduce themselves as well and, since IGF-1 is a primary factor, along with growth hormone, in the ability of cells to grow and reproduce, it is highly desirable to have an appropriate level of IGF-1 in the circulation through dietary supplementation to limit the ever increasing rate of cell death.

Leptin is a small, hormone-like protein that is present in first milking bovine colostrum. It can suppress appetite and is involved in regulating the metabolism of fats. Insulin, which is also found in colostrum, and leptin work together. When insulin is present, mature fat cells (adipocytes) in the body release leptin. It is also believed that the size of the fat cells is a major factor in determining how much leptin will be released, small fat cells release more than large fat cells. In addition, there are sites on the surface of the cells in the pancreas that produce insulin where leptin can attach. Therefore, a close relationship exists between the control of carbohydrate and fat metabolism and a deficiency in leptin may be associated with obesity.

From the above, we can conclude that making sure that we have sufficient quantities of IGF-1 and leptin in the bloodstream, as would occur by dietary supplementation with a high quality first milking colostrum, means assurance of more effective regulation of protein, carbohydrate and fat metabolism. When this is coupled with a well-balanced diet and moderate exercise, the end result will be more muscle and less fat - a leaner body mass. This becomes even more important as we age since metabolism increasingly slows naturally over the years.

In comparison to products that only offer the nutrients necessary to support glutathione generation, first milking bovine colostrum is an amazing natural resource of substances necessary to support the development and repair of cells and tissues, including, among other things, the cystine necessary to generate the antioxidant glutathione; assure the effective and efficient metabolism of nutrients; and maximize functioning of the immune system.

However, it is very important to recognize that all colostrum products are not the same and, despite the claims made by their manufacturers, they do not all contain every beneficial component at an optimum concentration and, in many cases, they have been manipulated and may be missing some of the essential components. When choosing a colostrum product, one should be certain that a) it is made from only first milking bovine colostrum collected within 6-8 hours after birth of the calf; and b) that the colostrum is "complete" and that none of the components have been removed, including the fat. I have personally been responsible for testing of several different brands of colostrum for human use and can attest that the results prove that the products distributed by Immune-Tree contain the highest quality complete first milking bovine colostrum available today.

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